WHAT IS CLAIMED IS:

1. An apparatus for electron multiplication by transmission, comprising:
   (a) at least one foil having a front side for receiving incident particles at a first energy level and a back side for transmitting secondary electrons produced from said incident particles transiting said foil from said front side to said back side,
   (b) said foil having a thickness effective for said incident particles arriving at said first energy level to transit from said front side to said back side with sufficient energy to produce secondary electrons in transit from said backside,
   (c) an anode arranged to collect negatively charged incident particles and said secondary electrons from said back side of said foil,
   (d) an evacuated enclosure containing and supporting said foil and said anode, and
   (e) an electrical power supply connected to said at least one foil and said anode to provide an electrical field gradient effective to accelerate said secondary electrons from said back side toward said anode.
2. The apparatus of claim 1 where said at least one foil is connected to said evacuated enclosure by at least one foil holder.
3. The apparatus of claim 2 where said at least one foil is a plurality of foils and where said at least one foil holder is a plurality of foil holders.
4. The apparatus of claim 3 where said electrical power supply is connected to each one of said plurality of foils to provide an electrical potential therebetween effective to accelerate said secondary electrons from a back side of one foil to a front side of an adjacent

foil with sufficient energy to transit said adjacent foil and produce additional secondary electrons at said back side of said adjacent foil.

5. The apparatus of claim 3 where said electrical power supply is a plurality of electrical power supplies where one power supply is connected to each foil to provide an electrical potential between each foil effective to accelerate said secondary electrons from a back side of one foil to a front side of an adjacent foil with sufficient energy to transit said adjacent foil and produce additional secondary electrons at said back side of said adjacent foil.

6. The apparatus of claim 1 where said at least one foil material is selected from the group consisting of electrical conductors, semiconductors, and dielectrics with finite electrical resistivity.

7. The apparatus of claim 1 where said at least one foil material is selected from the group consisting of carbon, metal, and metal alloys.

8. The apparatus of claim 1 where said at least one foil material is a hydrocarbon.

9. The apparatus of claim 3 where said at least one foil holder material is an electrical conductor.

10. The apparatus of claim 3 where said at least one foil holder material is selected from the group consisting of metal, metal alloys, semiconductors, and insulators with a finite resistance.

11. The apparatus of claim 2 where said at least one foil holder is connected to a grid that supports said at least one foil.

12. The apparatus of claim 11 where said grid material is an electrical conductor.

13. The apparatus of claim 11 where said grid material is selected from the group consisting of metal, metal alloys, semiconductors, and insulators with a finite resistance.

14. The apparatus of claim 1 where said anode comprises a conductive material.
15. The apparatus of claim 1 where said anode comprises a scintillator material that converts electrons to light.
16. The apparatus of claim 1 where said anode comprises a phosphor scintillator material.
17. The apparatus of claim 3 where said plurality of foil holders align said plurality of foils collinearly.
18. The apparatus of claim 3 where said plurality of foil holders align said plurality of foils in an arc.
19. The apparatus of claim 1 where said at least one foil has an areal thickness from about 0.2 $\mu g/cm^2$ to about 2 $\mu g/cm^2$.
20. The apparatus of claim 1 where said at least one foil has an areal thickness of 0.2 $\mu g/cm^2$ to 1 $\mu g/cm^2$.